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STS-2[illegible]scovery:
Americ[illegible]Returns

STS-26 Mission Accomplished, America Returns to Space

Discovery Crew

Frederick H. (Rick) Hauck, (center) Captain, USN, Mission Commander. Selected as an astronaut in 1978, Hauck was pilot for STS-7, June 1983, and commander of Discovery's second mission, STS-51-A, November 1984 , the first mission to retrieve satellites and return them to Earth. He has now logged 436 hours in space.

Richard O. (Dick) Covey, (2nd right) Colonel, USAF, STS-26 Pilot. Covey was selected as an astronaut in 1978. He was pilot on STS 51-I which deployed three satellites and retrieved, repaired and redeployed the ailing Leasat/Syncon IV-F3 satellite. Covey has logged more than 267 hours in space.

John M. (Mike) Lounge, (2nd left) Mission Specialist 1 on STS-26. Selected as an astronaut in 1980, Lounge was a mission specialist on Discovery's previous flight, STS 51-I, deploying the Australian Aussat communications satellite. He has now logged more than 267 hours in space.

David C. Hilmers, (left) Lt. Col. , USMC, Mission Specialist 2 for STS-26. Hilmers was selected as an astronaut in 1980. He served as a mission specialist on the Atlantis STS 51-J flight, a dedicated Department of Defense mission in October 1985. Hilmers has logged more than 195 hours in space.

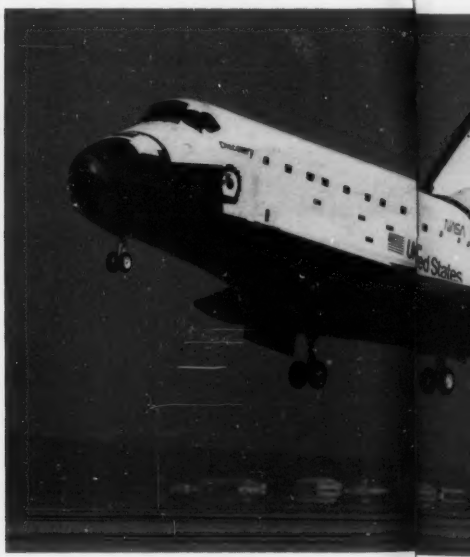
George D. (Pinky) Nelson, (right) Mission Specialist 3 on STS-26. Selected as an astronaut in 1978, Nelson also served as mission specialist on STS 41-C which deployed the Long Duration Exposure Facility and repaired and redeployed Solar Max, and on STS 61-C which deployed the Satcom KU satellite. He has 411 hours in space, nine hours of which includes the EVA repair of Solar Max.

Flawless Flight Underscores Redesign, Management Improvements

The Space Shuttle returned to flight September 29, when the orbiter Discovery was launched on its seventh flight from John F. Kennedy Space Center, Florida.

STS-26 had as its primary payload the Tracking and Data Relay Satellite (TDRS-C) that will complete the constellation needed to communicate with spacecraft in low-Earth orbit. A third TDRS will be launched on a later Shuttle mission to replace the first TDRS, which then will be used as an on-orbit spare in the event that one of the two operational satellites fails.

Discovery was launched from the Kennedy Space Center's Launch Pad 39-B, into a 184-



statute-mile, 28.5 degree orbit. Liftoff was at 10:59 a.m. EDT and mission duration was 4 days, 1-1/2 hours, with landing at NASA Ames-Dryden Flight Research Facilty, Edwards AFB, Calif., October 3, at 12:37 a.m. EDT.

TDRS-C was deployed 6 hours, 13 minutes into the mission on flight day one. The 5,000-pound satellite will join the first TDRS, deployed on STS-6 in April 1983, to provide communications and data links between Earth and the Shuttle, as well as other spacecraft.

TDRS-A is now in geosynchronous orbit (22,300 mi.) over the Atlantic Ocean east of Brazil (41 degrees west longitude). TDRS-C is being tested and will be moved to its operational position over the Pacific Ocean south of Hawaii (171 degrees W. longitude) at about year's end.

An Air Force-developed inertial upper stage (IUS) boosted the TDRS to geosynchronous orbit. The IUS was mated to the TDRS-C and the combination spacecraft and upper stage was spring ejected from the orbiter payload bay.

Following deployment, Discovery was maneuvered to a position 41.4 statute miles behind and 18.4 statute miles above the TDRS-C/IUS before the two-stage motor ignited about 60 minutes after deployment. The three-axis, stabilized upper stage maneuvered the TDRS to the desired attitude. TDRS was then configured for operation by the White Sands Ground Terminal, N.M.

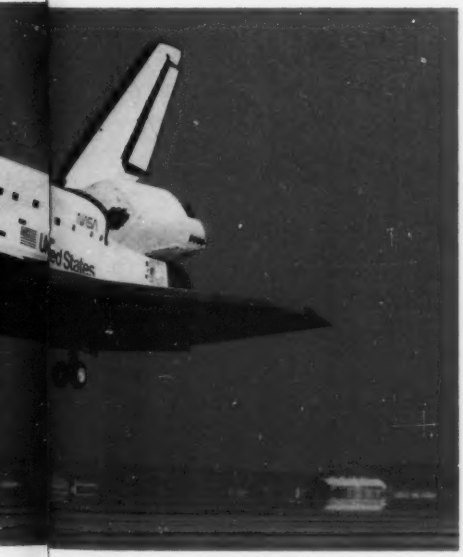
CONTEL, Atlanta, Ga., owns and operates the TDRS system for NASA. TRW's Defense and Space Systems Group, Redondo Beach, Calif., built the TDRS satellites.

The Orbiter Experiments Program Autonomous Supporting Instrumentation System (OASIS) was flown on STS-26 to record environmental data in the orbiter payload bay during STS flight phases. OASIS measured TDRS vibration, strain, acoustics and temperature during orbiter ascent, using transducers affixed directly to the payload.

OASIS flight hardware consisted of signal conditioning, multiplexing and recording equipment mounted on a Shuttle adaptive payload carrier behind the TDRS. Command and status interface was achieved through the standard mixed cargo harness and the general purpose computers.

In addition to TDRS-C and OASIS, Discovery carried 11 secondary payloads, including two student experiments, involving microgravity research, materials processing and electrical storm studies.

After landing at Edwards, Discovery was towed to the NASA Ames-Dryden Flight Research Facility mate/demate area, hoisted atop the Shuttle Carrier Aircraft and ferried back to the Kennedy Space Center to begin processing for its next flight. ■



TDRS-C Second Satellite Expands Communications Web, Permits More Efficient Space Operations

by James Hartsfield, JSC

As TDRS-3 (TDRS C prior to orbit) unfolded two giant golden spider webs 22,300 miles above the Pacific, it opened the eyes and ears of NASA to almost the entire sky. And those are no small eyes and ears, since a fully operational TDRS (Tracking and Data Relay Satellite) can relay an amount of information roughly equivalent to 100 encyclopedias each second. TDRS is the largest communciations satellite ever launched, with an unfolded solar array measuring from tip to tip longer than a seven-lane freeway is wide. The two web-like dish antennas are each more than five yards across and are set in an array that spans 42 feet. The complete TDRS system, consisting of three satellites, will forever change the way NASA has communicated with spacecraft since its first manned space flight.

TDRS-3 deployment gives flight controllers direct communication with the Shuttle for about 85 percent of each orbit, meaning the ground will be out of contact for only about 13 minutes of each revolution. At present TDRS-3's predecessor in space, TDRS-1, launched in 1983 and now stationary above the Atlantic Ocean, allows controllers to be in contact with the Shuttle for about 50 minutes of each 90-minute orbit. Prior to TDRS-1, the Mission Control Center (MCC) relied solely on the ground tracking network, a plethora of stations around the globe that together allow less than 20 minutes of contact during each orbit.

The complete TDRS system includes a third satellite, TDRS-D, scheduled for launch aboard STS-29 in early 1989. The third satellite originally was intended as a spare to be positioned in geosynchronous orbit above the continental United States. But, because of problems with TDRS-1, TDRS-D will replace that satellite above the Atlantic while TDRS-1 assumes spare duties above the U.S.

TDRS-C just prior to deployment.

TDRS-3's deployment makes the complete satellite system functional for the first time. "Everyone's excited about the capabilities it's going to give us," Chuck Shaw, a Shuttle flight director, said. "Before, we'd just get periodic glimpses, like a look through a keyhole, but now the door will be wide open."

Since the start of the space program, work in the MCC has revolved around a staccato rhythm of AOS (Acquisition of Signal) and LOS (Loss of Signal). But with the full TDRS system, LOS may become a far less familiar acronym. And the almost constant communications will allow far more flexibility in operations.

"Flexibility is the big thing–we don't have to wait until all the stars line up, so to speak, to talk to the crew," Shaw said. At times, certain events had to be geared to coincide with the AOS from ground stations, he explained.

"For instance, we had to schedule payload tests while we were over one. To me, that's the biggest single impact–to not have to do things at specific times just because of network coverage," Shaw said.

Although it will not yet be in its permanent position, TDRS-3 is scheduled to be used during STS-27, giving controllers their first taste of the full communications offered by the system.

With the full TDRS system, flight controllers will be able to monitor live data almost constantly, and they will see a problem the minute it happens. Traditionally, data from LOS periods has been "dumped" at high speeds from the Orbiter at AOS. To study any problem with an onboard system, controllers had to replay the data, a process that could mean the information wasn't actually reviewed until, sometimes, 30 or

40 minutes after the trouble occurred.

"You can react a lot quicker to any situation that comes up, because you're in almost constant communication ... and you have more time and more breathing room to work out problems," said Jim Brandenburg, Mission Control Center network operations control manager.

NASA's ground tracking network, established during Project Mercury, will eventually be phased out. However,some stations will remain to support expendable launch vehicles and to support Orbiter landings.

"It's a much more efficient use of on-orbit resources," Shaw said. "As an overall system, it'll be a whole lot cheaper than operating ground sites. It should save taxpayers a lot of money."

For astronauts, full TDRS coverage of missions may actually reduce radio chatter from what it is now, said STS-26 Mission Specialist Mike Lounge, who had the lead, on-orbit responsibility for TDRS-C's deployment. "A lot of the chatter now is from checking in and checking out. The 'hellos' and 'goodbyes' are probably 80 percent of what we say," Lounge explained. "With 85 percent coverage, you'll be surprised at how quiet it is.

Three replacement TDRS satellites will be launched as needed to keep TDRS fully operational, with TDRS-E scheduled for a mid-1990 launch to untimately replace TDRS-1, which will be deactivated. A second-generation TDRS system is already being studied. The ground station for TDRS communications is at the White Sands Test Facility. A backup facility is now under construction at White Sands to provide TDRS operations in case of a failure at the main facility. ■

STS-26 Carries a Variety of Experiments

Physical Vapor Transport of Organic Solids– Production and study of organic thin films with ordered crystalline structures was the object of this 3M Company experiment.

Protein Crystal Growth– 60 different crystal growth experiments with as many as 10 distinct proteins were expected to advance knowlege of specific protein molecules to understand their biological functions. This could lead to new drugs to fight diseases from AIDS to cancer.

Infrared Communications– Using infrared light for communication rather than radio frequency waves, this experiment demonstrated feasibility of secure transmissions within the orbiter.

Automated Directional Solidification Furnace– Demonstrating the possibility of lighter, stronger, better performing magnetic composite materials was the object of this experiment which constantly melts and resolidifies linear samples.

Aggregation of Red Blood Cells– Designed to provide information on the formation rate, structure and organization of red cell clumps and thickness of whole blood cell aggregates at high and low flow rates, the objective was to determine if microgravity can play a role in new and existing clinical research and medical diagnostic tests.

Isoeletric Focusing– This electrophoresis experiment separated proteins in an electric field according to their surface electrical charge.

Mesoscale Lightning– To understand the effects of lightning discharges on each other, on nearby storm systems and on storm microbursts and wind patterns and interrelationship of these over a large geographical area, this experiment gathered lightning images using color video and 35mm film cameras.

Phase Partitioning– Separating cell types with important biomedical characteristics is necessary to study those characteristics. This experiment is designed to increase understanding the role of gravity and other physical forces in "partitioning" biological

Continued on page 15

Nelson (left) and Hilmers with SSIP experiment.

Space Shuttle Redesign, Modifications and Tests Provide Foundation for Return to Space

Solid Rocket Motor Redesign

On June 13, 1986, the President directed NASA to implement the recommendations of the Presidential Commission on the Space Shuttle Challenger Accident. As part of satisfying those recommendations, NASA developed a plan to provide a redesigned solid rocket motor (SRM).

The primary objective of the redesign effort was to provide an SRM that is safe to fly. A secondary objective was to minimize the impact on the launch schedule by using existing hardware, to the extent practical, without compromising safety.

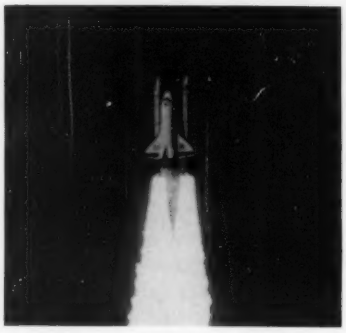
A redesign team was established which included participation from Marshall Space Flight Center; Morton Thiokol, NASA's prime contractor for the SRM; other NASA centers; contractors and experts from outside NASA.

All aspects of the existing SRM were assessed. Design changes were deemed necessary in the field joint, case-to-nozzle joint, nozzle, factory joint, local propellant grain contour, ignition system and ground support equipment. Design criteria were established for each component to ensure a safe design with an adequate margin of safety.

Field Joint–The field joint metal parts, internal case insulation and seals were redesigned and a weather protection system was added.

The major motor case change is the new tang capture feature which provides a positive metal-to-metal interference fit around the circumference of the tang and clevis ends of the mating segments. The interference fit limits the deflection between the tang and clevis o-ring sealing surfaces due to motor pressure and structural loads. The joints are designed so the seals will not leak under twice the expected structural deflection and rate.

External heaters with integral weather seals were incorporated to maintain the joint and o-ring temperature at a minimum of 75 degrees F. The weather seal also prevents water intrusion into the joint.



Space bound, Discovery departs NASA Kennedy Space Center.

The new design, with the tang capture feature, the interference fit and the use of custom shims between the outer surface of the tang and inner surface of the outer clevis leg, controls the o-ring sealing gap dimension.

The new field joint design also includes a new o-ring in the capture feature and an additional leak check port to assure that the primary o-ring is positioned in the proper sealing direction at ignition.

The field joint internal case insulation was modified to be sealed with a pressure actuated flap called a J-seal, rather than with putty as in the STS 51-L configuration.

Longer field joint case mating pins, with a reconfigured retainer band, were added to improve the shear strength of the pins and increase the margin of safety in the metal parts of the joint.

Case-to-Nozzle Joint–Similar to the field joint, case-to-nozzle joint modifications have been made in the metal parts, internal insulation and o-rings. Radial bolts with "Stato-O-Seals" were added to minimize the joint sealing gap opening.

The internal insulation was modified to be sealed adhesively and a third o-ring included.

The polysulfide adhesive replaces the putty used in the 51-L joint. Also, an additional leak check port was added to reduce the amount of trapped air in the joint during the nozzle installation process and aid in the leak check procedure.

Nozzle–The internal joints of the nozzle metal parts have been redesigned to incorporate redundant and verifiable o-rings at each joint. The nozzle steel fixed housing part has been redesigned to permit incorporation of 100 radial bolts that attach the fixed housing to the case aft dome.

Improved bonding techniques are used for the nozzle nose inlet, cowl/boot and aft exit cone assemblies. The nose inlet assembly metal part to ablative parts bondline distortion has been eliminated by increasing the thickness of the aluminum nose inlet housing and improving the

bonding process. The tape wrap angle of the carbon cloth fabric in the areas of the nose inlet and throat assembly parts were changed to improve the ablative insulation erosion tolerance.

Some of these ply angle changes were in progress prior to the STS 51-L accident. The cowl and outer boot ring has additional stuctural support with increased thickness and contour changes to increase their margins of safety. Additionally, the outer boot ring ply configuration was altered.

Factory Joint–Minor modifications were made in the case factory joints by increasing the insulation thickness and altering the lay-up to increase the margin of safety on the internal in sulation. Longer pins also were added, along with a reconfigured retainer band and new weather seal to improve the factory joint performance and increase the margin of safety. The o-ring and o-ring groove size also were changed consistent with the field joint.

Propellant–The motor propellant forward transition region was recontoured to reduce the stress fields between the star and cylindrical portions of the propellant grain.

Ignition System–Several minor modifications were incorporated into the ignition system. The aft end of the igniter steel case, which contains the igniter nozzle insert, was thickened to eliminate a localized weakness. The igniter internal case insulation was tapered to improve the manufacturing process.

Ground Support Equipment–The Ground Support Equipment (GSE) has been redesigned to minimize the case distortion during handling at the launch site; to improve the segment tang and clevis joint measurement system for more accurate

Continued on page 12

MAJOR ORBITER MODIFICATIONS

More than 100 mandatory modifications to the orbiter Discovery were completed before returning to flight. Major modifications include:

• **Brake Improvements**–These changes were made to eliminate mechanical and thermally-induced brake damage, improve steering margin and reduce the effects of tire damage or failure. Modifications for the STS-26 flight were the thicker stators, stiffened main landing gear axles, tire pressure monitoring and anti-skid avionics.

• **17-Inch Disconnect**–A positive hold-open latch design feature for the main propulsion system disconnect valves between the orbiter and the external tank (ET) was developed to ensure that the valve remains open during powered flight until nominal ET separation is initiated.

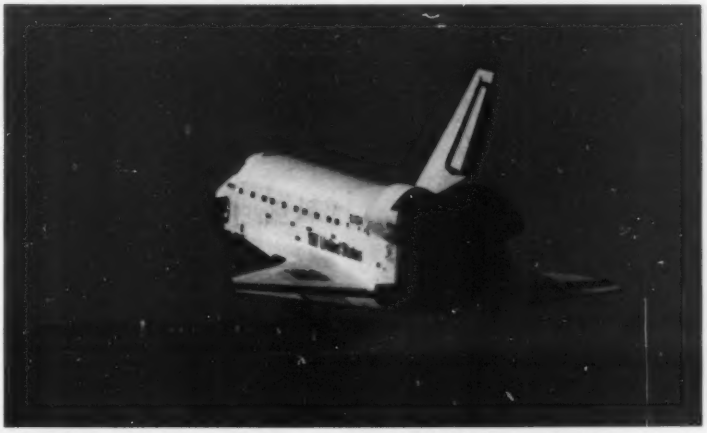
• **Reaction Control System Engines**–The RCS engines provide on-orbit attitude control and have been modified to turn off automatically in the event any combustion instability were to cause chamber wall burn through.

• **Thermal Protection System**–The TPS was improved in areas on the orbiter in the wing elevon cove region, nose landing gear door, lower wing surface trailing edge and elevon leading edge.

• **Auxiliary Power Unit**–An electrical interlock has been added to the APU tank shutoff valves to preclude electrical failures that could overheat the valves and cause decomposition of the fuel (hydrazine).

• **Orbital Maneuvering System**–To prevent development of leaks as a result of improper manufacturing processes, bellows in critical OMS propellant line valves have been replaced.

• **Crew Escape System**–A pyrotechnically jettisoned side hatch, crew parachutes and survival gear and a curved telescoping pole to aid the crew in clearing the wing, have been added to give a bail-out capability in the event of a problem where runway landing is not possible. An egress slide has been added to facilitate rapid postlanding egress from the vehicle under emergency conditions. ■



STS-26 Discovery concludes mission at NASA Ames-Dryden.

THIS ISSUE

The United States returned to manned spaceflight September 29 with an STS-26 mission that could only be called glorious. This issue of NASA Activities highlights the **"Return to Space"** mission, its crew, payload, experiments and the modifications that have been made to make a better Space Shuttle.

NASA Activities devotes the first section this month exclusively to the STS-26 flight.

"Inside NASA" features NEBA, the NASA Employee Benefit Association. NEBA's 37 years of constantly improving service to employees, employee and management support are covered.

Sixty-thousand feet over Yellowstone is not the title of a new movie. NASA's high altitude ER-2 research aircraft provided aid for forest fire fighting management in recent Yellowstone fires. Infrared sensing permits better martialing of fire fighting resources.

New generations of jet fighters may have much greater capabilities if the futuristic full-scale E-7 STOVL model being studied in NASA wind tunnels is an indicator. NASA aeronautics researchers, as well as U.S. and Canadian corporate researchers are putting the model to the test.

Rolling it out the door is not the first image that comes to mind when you think of deploying satellites from an orbiter. But JSC engineers think the concept will offer a lightweight, compact payload deployment system that will allow larger, heavier payloads in certain cases.

Farewell... NASA wishes well to departing congressmen in this issue of Congressional Corner. Their dedicated service to the country and the space program is underscored.

Next Month:

Our first trip to the Moon: A remembrance of Apollo 8

CONTENTS

Special "Return to Flight" Section

STS-26 Discovery Crew 2
STS-26 Mission Accomplished, the U.S. Returns to Space 2
TDRSS Expands Communication Web 4
STS-26 Experiments 5
Space Shuttle Redesign, Modifications and Tests 6

"Inside NASA": NEBA's 37th Successful Year 9

Agency Highlights

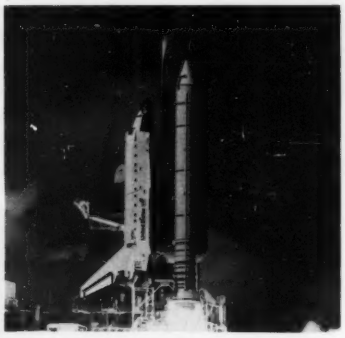
NASA High Altitude Aircraft Help Manage Forest Fires 10
Space Station Freedom Contract Negotiations Concluded 11
Space Station Accords Signed 11
National SSIP Winners Announced 12

Center Highlights

Supersonic STOVL Jet Model Faces Tests 13
Heavy Duty Lightweight 14

Departments

Q&A: COBE and the "Big Bang" 15
Congressional Corner 16
NASA News Capsules 17
1988 Presidential Rank Awardees 18
NASA Human Factor 19



About the Cover

The Space Shuttle Discovery and its five-man crew embarks on its four-day, one-hour mission, September 29, 1988, signaling America's return to space. The job: to launch a Tracking and Data Relay Satellite. **Back Cover:** Vice-President George Bush greets the triumphant crew following landing in California's Mojave Desert.

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INSIDE NASA

NASA Employees Benefit Association Enjoying 37th Successful Year

by Nevada Burke, Hqs

Planning for voluntary, low-cost group life insurance for the National Advisory Committee for Aeronautics (NACA) started at the Lewis Research Laboratory in Cleveland, Ohio in 1950. At that time, there was no Federal Civil Service-sponsored group insurance, although some agencies sponsored their own group insurance. Federal law and existing regulations permitted the head of an agency to contract for life insurance coverage for the employees, provided the plan was on a voluntary basis.

Dr. Ray Sharp, director of the Lewis Laboratory, appointed an "insurance committee" to investigate the possibility of securing low-cost group life insurance for the benefit of the NACA employees. As a result of the committee's investigations, proposals were solicited from various carriers. The Home Life Insurance Company of New York was selected as the carrier offering the most competitive program to the NACA employees.

In 1952, Dr. Hugh L. Dryden, NACA director, signed the agency's first life insurance contract. The program became popular and soon spread to NACA Headquarters and to all other NACA installations and later to all NASA installations as they came into being.

The NACA Employees Benefit Association (NEBA) was established by Dr. Dryden to administer the program. The charter stated, "The Association shall be conducted for the mutual benefit of its members and their beneficiaries and not for profit."

NASA Administrator Dr. James C. Fletcher, received a plaque last December on behalf of all of NASA employees from Mr. Kenneth C. Nichols, Chief Executive Officer, Home Life Insurance Company, celebrating our 35th anniversary working together. This plaque is on display in the lobby of FB-10 in Washington.

Since its inception, the program has extended coverage to include spouses and other dependents. NEBA offers Basic Group Life Insurance (the original plan), Optional Insurance and Travel Accident Insurance.

Over the years, the unit cost has decreased. The 1952 schedule provided for seven classes, ranging in coverage from $1,000 to $10,000 on the life of the employee only. The 1952 rate was $2.40 per quarter, per thousand dollars of coverage.

Today, the Basic Life Insurance coverage has 12 classes, ranging from $20,000 to $85,000 per enrolled employee, plus double indemnity in case of accidental death. Coverage is age-based and ranges from 55 cents per thousand per quarter to $1.10 per thousand per quarter. Members range from the lowest to the highest salaried NASA personnel.

In 1963, NEBA furthered its employee protection services by offering a seperate travel accident policy. This plan was expanded to offer coverage up to $100,000 for both business and personal worldwide travel plus $10,000 spouse coverage.

In 1968, Optional Dependent Life Insurance coverage was added to the basic life insurance, providing spousal coverage and coverage for dependent children with a guaranteed option to convert to a $25,000 permanent life insurance policy with Home Life at age 19.

In 1984, Optional Insurance was offered to Basic Plan members which provides for additional protection ranging from $25,000 to $150,000. Quarterly premium rates (based upon age) range from $.24 to $6.00 per thousand for non-smokers, to $.29 to $9.00 per thousand for smokers.

Today, NEBA provides approximately 9,000 NASA employees with over $800,000,000 in life

Continued on page 19

AGENCY HIGHLIGHTS

Ames High Altitude Aircraft Help Manage Forest Fires

Airborne Sensors See Through Yellowstone Smokescreen

NASA Ames Research Center's ER-2 and C-130 aircraft flew multiple infrared thermal mapping missions over the Yellowstone National Park area to aid the fire control efforts in that region this September. NASA's remote sensing aircraft were equipped with thermal infrared sensors that could "see"

A NASA Research Pilot boards the high altitude ER-2 aircraft.

through the thick layers of smoke blanketing the park and national forest area.

Data reduction systems and high resolution television monitors, ground based at Greater Yellowstone Area Unified Command in West Yellowstone, Montana, for the ER-2 and flown on board the C-130, gave fire officials valuable real time images of new fires and the advancing fire front. Knowing the size, speed, and intensity of the fires helped fire officials prioritize their available manpower and equipment.

NASA's ER-2, flying at approximately 65,000 feet and 460 mph, provided the only complete thermal map of the 4,000 square mile fire area, in less than two hours. The aircraft's multispectral scanner records energy from 11 discrete wavelength bands of visible and thermal infrared spectra.

A NASA downlinking capability, transported to the fire control center at West Yellowstone, made the scanner information immediately available to fire officials and the firefighting teams. The digital thermal data was transmitted to the ground receiver, computer enhanced, and displayed on a high resolution television screen at the fire control center. NASA personnel at the West Yellowstone ground station transcribed thermal data onto topographical maps for the firefighting teams.

NASA's C-130 aircraft, flying at 20,000 -25,000 feet at 230 mph, recorded higher resolution information on particular fires in the park. The aircraft was equipped with a multispectral scanner and had the data reduction and video image display system on board. Interpretation and mapping of the fire area was done in real time by U.S. Forest Service personnel while on the aircraft.

Fire and smoke research, headed by Mr. James Brass, has been conducted at Ames since 1984. A base of equipment and experience has been developed that examines nutrient cycling and atmospheric chemistry on local, regional and global scales.

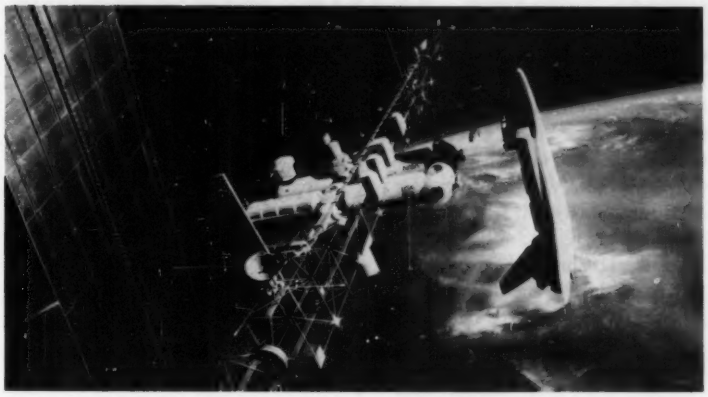
The research team includes United States Forest Service Riverside Fire Laboratory, Environmental Protection Agency, universities, and other national laboratories. Research data was collected on the NASA/U.S. Forest Service Yellowstone collaborative flights. A NASA/U.S. Forest Service ER-2 mission is planned for spring of 1989, to map regrowth and ecosystem changes in the Greater Yellowstone Area.

Ames' C-130, Earth Resources Laboratory, is now deployed to Hawaii mapping unexposed lava flows beneath the land mass and ocean. Lava flows from crusted lava lakes in tubes that are solid on the outside, magma flowing in the center. The C-130's multispectral scanner will record thermal infrared imagery of these tubes for Dr. Dave Pieri, Principal Investigator, NASA JPL. ■

Visual spectrum view obscures ground features, shows plume.

Infrared image shows burned areas, super heated soils and fire.

Space Station Freedom Contract Negotiated



Artist concept of enhanced configuration of Space Station Freedom.

NASA has concluded contract negotiations for full-scale development of the permanently manned space station Freedom.

In December 1987, NASA selected Boeing Aerospace Co., Huntsville, Ala., McDonnell Douglas Astronautics Co., Huntington Beach, Calif., GE Astro-Space Division, Vally Forge, Penn., and East Windsor, N.J., and Rocketdyne Division of Rockwell International, Canoga Park, Calif., for negotiation of cost-plus-award-fee contracts to design, develop, test and evaluate, and deliver the components and systems comprising the space station Freedom. This action marks the successful settlement of those contracts.

The 10-year contracts with these four aerospace firms have a total value of approximately $6.7 billion.

The Marshall Space Flight Center's contract with Boeing is valued at approximately $1.6 billion, not including priced options for additional work or elements that would be provided for the Phase 2, or enhanced, space station configuration. Under its contract with Marshall, Boeing will develop the U.S. laboratory and habitation module, logistics elements, structures for the resource nodes, the environmental control and life support system, internal thermal, and internal audio and video systems, and associated software.

The Johnson Space Center's contract with McDonnell Douglas Astronautics Co., is valued at approximately $2.6 billion, not including priced options for additional work or Phase 2 elements.

Under its contract with JSC, McDonnell Douglas will outfit the resource nodes and develop the integrated truss structure, mobile servicing system transporter, airlocks, and hardware and software for the data management; communications and tracking; guidance, navigation and control; extravehicular activity; propulsion, and thermal control systems.

Goddard's contract with GE Astro-Space Division is valued at approximately $895 million, not including priced options for additional work or Phase 2 elements. The contract calls for GE to provide a free-flying, unmanned polar-orbiting platform, and various attach-point hardware, including a pointing system for accommodating external scientific instruments on the manned base.

The Lewis Research Center's contract with Rocketdyne is valued at approximately $1.6 billion, not including priced options for additional work or Phase 2 elements. Rocketdyne will provide the 75 kilowatt electrical power and distribution system for Freedom's manned base and the U.S. polar platform. ■

Space Station Accords Signed

Formal agreements for space station cooperation have been signed by participating member nations. In ceremonies September 29, in Washington, D.C., a multilateral intergovernmental agreement among the United States, Japan, Canada and the nine member states of ESA participating in the program (Belgium, Denmark, France, Italy, the Federal Republic of Germany, the Netherlands, Norway, Spain, and the United Kingdom) outlined the broad principles of the rights and obligations of the partners, including the legal regime within which the program will operate.

Two bilateral memorandums of understanding (MOUs) that focus on programmatic and technical aspects of the program and establish the management mechanisms necessary to implement the program were signed by NASA and ESA and NASA and Canada's Ministry of State for Science and Technology. The MOU with Japan is expected to be signed this Spring.

National Space Science Student Proposal Winners Annouced

NASA and the National Science Teachers Association held the 8th annual Space Science Student Involvement Program (SSIP) competition in Washington, D.C., recently. The national SSIP winners were in three competition categories: Space Station proposal; student newspaper promotion; and aerospace internship.

In the national Space Station proposal competition, seven regional winners presented proposals to the selection panel. Selected from over 900 proposals, the following are the three national scholarship recipients, their proposals and awards:

First Place: John C. Marschhausen, Glastonbury, Conn. Topic: "Detrimental Loss of Calcium Due to Microgravity." He was awarded a scholarship of $3,000 and an Apple computer of his choice.

Second Place: Kartik A. Parekh, Los Angeles, Calif. Topic: "Effect of Space Environment on the Proliferation of Resting, Activated and Malignant T-(213) Lymphocytes." Parekh was awarded a scholarship of $2,000 and an Apple computer of his choice.

Third Place: P. Martin Johnson, Baton Rouge, La. Topic: "Frogs in Space: The Growing and Muscular Training of Rana Pipens in a Weightless Environment. Johnson was awarded a scholarship of $1,000 and an Apple computer of his choice.

The selection panelists for the Space Station proposals were Dr. John-David Bartoe, chief scientist, Office of Space Station, NASA Headquarters; Donna Bartoe, technical management assistant, Office of Space Station, NASA Headquarters; Michael Weiss, flight systems manager, NASA Goddard Space Flight Center, Greenbelt, Md.; and Sister Mary Carol McCaffrey, biology teacher at Mount St. Joseph Academy, Slaughtertown, Pa., and SSIP Region VIII director.

In addition to the Space Station proposal winners, three national student winners in the student newspaper competition and the aerospace internship competition were honored during the NASDA/NSTA National Space Science Symposium.

The national student newspaper award winner is DeAnne M. Nevis, Lambert, Mont. Her article was titled "Hey Student! It's Your Chance to Get SPACY!" She was awarded a $500 scholarship.

> Objective: Stimulate interest in science and technology by directly involving students...

The two national aerospace internship award winners will each spend one week at a NASA research facility interacting with scientists and engineers involved in wind tunnel or zero gravity facility programs. The two winners and their proposals are: Eliah D. Novin, Sherman Oaks, Calif. Topic: "Control Surface Testing on a Forward Sweep Prototype Aircraft." Kenneth L. Riley, Akron, Ohio. Topic: "Measurement of Tensile Strength on Pure Water." ■

REDESIGN
From page 7

reading of case diameters to facilitate stacking; to minimize the risk of o-ring damage during joint mating; and to improve leak testing of the igniter, case and nozzle field joints.

Other GSE modifications include transportation monitoring equipment and lifting beam.

Test Program–An extensive test program was conducted to certify the redesigned motor for flight. Test activities included laboratory and component tests, subscale tests, simulator tests and full scale tests.

Five full scale, full duration motor static firing tests were conducted prior to STS-26 to verify the redesigned solid rocket motor performance. These included two development motor tests, two qualification motor (QM) tests, and a production verification motor test. Additionally, one post-STS-26 QM test is scheduled in late December to certify the redesigned motor for cold weather operation.

Space Shuttle Main Engine Improvements

The main engines for Space Shuttle flight STS-26 incorporated numerous improvements over those on previous flights.

In terms of hardware, areas of improvement include the electronic engine controller, valve actuators, temperature sensors, main combustion chamber and the turbopumps.

In the high pressure turbomachinery, improvements have focused on the turbine blades and bearings to increase margin and durability. The main combustion chamber has been strengthened by nickel-plating a welded outlet manifold to give it extended life. ■

CENTER HIGHLIGHTS

Supersonic STOVL Jet-Model Faces Tests

Aerodynamics and propulsion tests of a full-scale powered wind tunnel model based on the General Dynamics Corp. designed E-7 STOVL (Short Take-Off and Vertical Landing) aircraft are being conducted at NASA Ames Research Center.

NASA, the U.S. Department of Defense Advanced Research Projects Agency and the Canadian Department of Regional Industrial Expansion are conducting the tests.

The wind tunnel model was jointly designed, fabricated, and assembled by NASA and Boeing of Canada, de Havilland Aircraft Division, and is powered by a Rolls Royce Spey 801-SF engine.

In early August, the E-7 supersonic jet-model was placed in the Outdoor Aerodynamic Research Facility (OARF) for its initial propulsion system tests. These tests were successfully completed. Next, the E-7 model will be installed in the recently modified 40-by-80 Foot Wind Tunnel. It is anticipated that the E-7 model will be the first full-scale aircraft model to be tested in the new 80-by-120 Foot Wind Tunnel. These tests will measure the aerodynamic characteristics of the complete aircraft during low speed flight.

This aircraft concept is designed for takeoff from a short field, less than 500 feet long, and for a vertical landing from hover. During takeoff and landing, the flow from the engine is divided into two streams. The engine fan bypass flow powers the ejector and the turbine core flow powers the ventral nozzle.

For this concept in hover, lift is generated both by ejectors, located at the wing root on each side of the fuselage, and by a vertically vectored ventral nozzle. The engine fan air provides the source of the high pressure air for the ejector.

In the cruise mode, the fan air and the ventral nozzle are directed aft while the ejector areas are closed.

Future work with this model will include adapting the model to the more powerful GE F110 engine. This engine will be operated in a mixed flow mode. In hover both the engine bypass flow and core flow will be mixed. A portion of this high energy air will be ducted to the ejector and the remainder to the ventral nozzle to provide vertical lift.

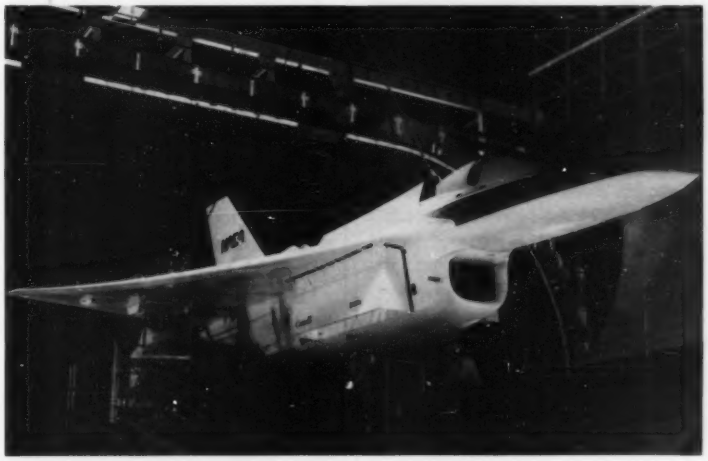
In cruise, the ejector and the ventral nozzle will be closed and the engine thrust will be controlled through an aft vectored thrust nozzle.

Following the current tests at Ames Research Center, the model will be transported to the de Havilland Division of the Boeing Company of Canada, Ltd., for adaptation to the model of the F110 engine. It will then be transported to Lewis Research Center.

Lewis will conduct the first testing of the modified model using the mixed flow mode and will validate the operation of the fully integrated flight/propulsion control system. This control system is generically similar to the control system required for most supersonic STOVL aircraft concepts.

After testing at Lewis, the model will be made available to Ames Research Center for additional wind tunnel and hover tests.

This is a unique opportunity to validate the performance of an ejector augmentor, a thrust improvement device, packaged in a supersonic airframe and configured for STOVL operation. ■



Technicians mount the E-7 full-scale powered STOVL model in preparation for wind tunnel tests.

Heavyduty Lightweight

New Payload Deployment System Rolls Cargo Away from Spacecraft

by Beverly Green, JSC

The developers of a new deployment system say rolling payloads over the orbiter's side rather than ejecting them upward may lead the way for the Shuttle to carry larger, heavier payloads aloft in the future.

Subsystem manager Guy King says other NASA payload deployment systems may soon tip their hats to the unique capabilities of the compact and lightweight Stabilized Payload Deployment System (SPDS).

SPDS, pronounced "spids," doesn't whip payloads out like a Frisbee or perform complex maneuvers such as those performed by the 1,300-pound Remote Manipulator System (RMS). Instead, it uses two motorized hinge-like devices attached to the side of the payload bay to lift the cargo out and to one side of the bay.

Then, pyrotechnics are used to release three pins that attach the payload to SPDS, and a small spring-loaded actuator gently pushes the payload away from the orbiter.

The RMS can perform more complex maneuvers, but SPDS's ability to release heavier payloads may introduce a new generation system that will become an alternate to the Shuttle's arm.

SPDS weighs in at 180 pounds and takes up only two feet at each end of the 63-foot-long payload bay. Because it is stiffer than the RMS, minor movement of the orbiter won't cause large changes in a massive payload's position. SPDS should be able to put into space a payload that weighs as much as 65,000 pounds.

Longer single payloads may be another advantage of the SPDS design because payloads will be released through rotation rather than ejection. SPDS takes up only two feet at each end of the 63-foot payload bay. The lightweight design is expected to be useful in a variety of payload deployment situations, including Space Station construction.

Rockwell has the job of fabricating the system, but initially two companies competed for the opportunity. Both contractors worked with NASA engineers to evaluate and refine the system based on the preliminary work done by the contractors.

"This blue ribbon team comprised of engineers, flight controllers and astronauts met religiously," said Bill Schneider, chief of the Mechanical Design and Analysis Branch.

"First designs, especially in the release mechanism, were simply inadequate. A group of JSC engineers was asked to go to Rockwell, take off their badges, sit down and work with Rockwell engineers to come up with a system that would work reliably," Schneider said.

Dr. Kornel Nagy, head of Structural Design Section, was one of the leaders of the blue ribbon team that developed the design and test plan. He helped identify about 60 needed changes during the preliminary design review.

JSC engineer Tom Graves had discussed using a three-pin toggle release mechanism and sketched a swivel toggle with three pins and the design won hands down. "But the toggle was bald on one end and Guy King decided to put another swivel on the other end," said Schneider. "Presently, we have a patent pending," he added.

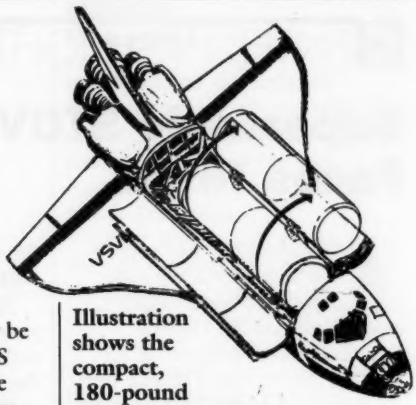


Illustration shows the compact, 180-pound SPDS mechanism.

"Therefore the system is not only lightweight, it's two-fault tolerant. Each pin is redundant so if only one pin functions, the entire system will work," he explained.

"This system can be visualized by looking at a door opening or closing. As one swings open a door the hinges will allow the slab of wood to move in a controlled manner," explained Schneider. The toggle may be thought of as motorized hinges, he said.

"Tight fitting payloads or heavy ones will be SPDS's main benefits," said David Grissom, office manager for Payload Integration Engineering office in NSTS Operations Integration Office. "SPDS was never intended to replace RMS, but only to provide unique applications," he said.

"We're presently in the early stage of the fabrication and testing of SPDS," said King.

A series of tests is planned throughout the year with a systems qualification test scheduled for completion by October 1989. ■

Q&A

The following questions and answers are excerpted from interviews conducted for NASA's radio program "The Space Story".

COBE and the "Big Bang"

The Cosmic Background Explorer, which early next year will be launched to search the heavens in 100 different wavelengths and with mind-boggling temperature discrimination, is expected to help us better understand the functions of the Universe.

Q What was the so-called "Big Bang", and how did it form the stars, planets and galaxies that we see today?

A According to Dr. Nancy Boggess, COBE deputy project scientist at NASA's Goddard Space Flight Center, "...we believe the universe began with an explosion, that the entire universe was once very, very small, very hot—billions of degrees in temperature—very dense, denser than anything we can conceive of and understand the physics of, with the universe as it is now.... When the universe became cool enough—and I'm talking in terms of millions of degrees, not billions of degrees—then the fundamental particles could then collect and because atoms, protons and electrons... all bodies, atoms, electrons radiate energy, and so it's this measurement of this radiation that we are seeking in the Cosmic Background Explorer.

Q How will COBE do this?

"...we'll be able to map out the entire sky... where there may have been clumps of matter or voids of matter that will show up as slight deviations in temperature, and we can detect differences in temperature down to .0001 degrees Kelvin. ...there are a number of things that could produce small deviations and there are many theories that try to explain how galaxies began and that there may have been black holes, and this (COBE's infrared spectrometer) will provide us observational evidence for this in the early history of our universe."

COBE will help us understand the functions and history of the universe which produced such great phenomena as Andromeda's Grand

Q IRAS, the Infrared Astronomical Satellite, did pioneering work in this area. How will COBE's contribution compare?

A "IRAS did not have the sensitivity to pick up the diffuse infrared background that we are discussing here for getting the remnant of the earliest objects formed in the universe, but IRAS gave us the catalogs of the thousands upon thousands of stars and galaxies that we can now do detailed research with...."

EXPERIMENTS
From page 5

substances between two unmixable liquid phases.

Earth-Limb Radiance– Photography of the Earth's "horizon twilight glow" near sunrise and sunset, will allow scientists to measure the radiance of the twilight sky as a function of the sun's position below the horizon, for more accurate horizon sensors for communications satellites.

Shuttle Student Involvement Program-Utilizing a Semi-Permeable Membrane to Direct Crystal Growth– Controlling crystal growth using a semipermeable membrane was the objective of this experiment.The shape of the semi-permeable membrane and the concentrations of two precursor compounds will determine crystal growth rate and shape without regard to other Earth-bound experiment factors.

Grain Formation and Strength in Metals– Titanium alloy was heated to near the melting point to observe the effect of weightlessness on crystal reorganization. ■

CONGRESSIONAL CORNER

NASA Giants to Retire

The Congressional Corner is written and edited by the Congressional Relations Office.

When the gavel strikes indicating the sine die adjournment of the 100th Congress, an era in NASA congressional relations will be brought to a close. Chairman Edward P. Boland (D-MA) of the House Subcommittee on HUD-Independent Agencies and Chairman William Proximire (D-WI) of the Senate Subcommittee on HUD-Independent Agencies have announced their retirement and will not return to the 101st Congress; both gentlemen have been crucial in the development of the annual NASA budget for many years.

Mr. Boland was first elected to the U.S. Congress in 1952, and soon thereafter was appointed to the prestigious House Committee on Appropriations - under House rules, those who serve on this "exclusive" Committee may not serve on any other standing committee. He took the reigns of the HUD-Independent Agencies Subcommittee, under which auspices NASA is funded, in 1971. The years 1971 -1974 were especially critical ones for NASA, the agency was asking the Congress to embrace the Space Shuttle as the next major program following the successful Apollo endeavor. As chairman of the Appropriations Subcommittee, Mr. Boland was instrumental in assuring that the Shuttle had a felicitious start.

With a judicious eye on the federal purse strings, yet also with a dedication to ensuring a strong civilian space program, Mr. Boland adeptly guided the NASA funding bill through 18 budget cycles. And this year–as his "swan song"–Mr. Boland, in the face of severe pressures on funding for the domestic discretionary elements of the Federal budget, in general, and NASA programs, in particular, crafted a FY 1989 NASA budget which provides almost the full funding request for the Space Station Freedom as a total budget of $10.7 billion, an increase of almost 20 percent over FY 1988. Colleague Congressman Bill Green (R-NY), eloquently reflecting on Mr. Boland's appropriations impact said, "I am constantly impressed with the encyclopedic knowledge of the gentleman from Massachusetts, his sense of feel of the will of the House with respect to how we should go forward, his sense of fairness in dealing not just with those of us on his subcommittee and not just with those on the Committee on Appropriations, but with all the members of the House as we craft this bill year."

Boland

Proxmire

In a 1957 special election, Mr. Proxmire became the first Democrat to win a Senate seat in Wisconsin in 25 years; since then he has been re-elected to the Senate by margins that most only dream about. Mr. Proxmire came to the Congress with a zeal to reduce, if not eliminate, government waste. His best known tactic for doing that is the "Golden Fleece" award given every month for the "biggest, most ridiculous or most ironic waste of the taxpayer's money." NASA in 1978 was the recipient of this award for the Search for Extra-Terrestrial Intelligence (SETI) program; the Senator quipped that SETI proposes communication between Earth and extra-terrestrial beings at a time "when people here on Earth–Arabs and Israelis, Greeks and Turks, the United States and the Soviet Union, are having a great difficulty in communicating with each other."

Upon assuming the chairmanship of the HUD-Independent Agencies Subcommittee in 1973, Senator Proxmire donned the garb of budget watchdog, becoming a thorough examiner of NASA's annual budget requests. However, Chairman Proxmire, at the same time, characterized NASA as one of the most efficient agencies in the Federal Government, and championed space science and other cooperative international space endeavors. After a hiatus as chairman for six years due to the majority having been captured by the Republicans (1981 - 1986), the Senator reclaimed the Subcommittee with the commencement of the 100th Congress.

The NASA community looks sadly on the departure of these key figures, but wishes them well in their retirement years. For the 101st Congress, according to the dictates of the seniority system, Congressman Bob Traxler, (D-MI), is anticipated to take the chairmanship of the House panel. Those in line for the Senate subcommittee include Senators Leahy (D-VT), Lautenberg (D-NJ) and Mikulski (D-MD). ■

NASA NEWS CAPSULES

News Capsules are NASA news releases edited by the Internal Communications Branch, Office of Communications.

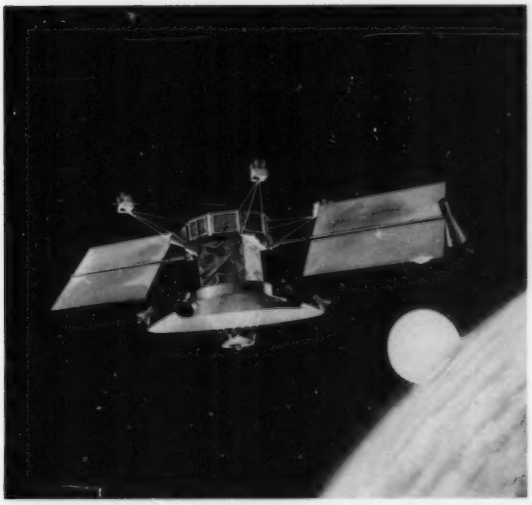
NASA Extends Jet Propulsion Laboratory Contract

The National Aeronautics and Space Administration (NASA) has extended its contract with the California Institute of Technology (Caltech), Pasadena, Calif., for the performance of research and development at NASA's Jet Propulsion Laboratory (JPL) for five years, from Oct. 1, 1988 through Sept. 30, 1993.

The cost-type contract is valued at approximately $5 billion over the five-year period.

The contract covers space exploration projects such as the Magellan mission to Venus and the Galileo mission to Jupiter, and the continuing Voyager missions to the outer planets. A variety of studies of Earth, its atmosphere, climate, geology and geophysics also are covered in the contract.

JPL's studies, for NASA's Office of Space Science and Applications, are principally concerned with space science and unmanned exploration of the moon and planets. Work also is performed in the areas of space technology, applications, aeronautics, biomedicine and national defense. The contractual relationship reflected by the present contract has been in effect since 1961.



Artist conception of Magellan spacecraft mapping Venus. JPL manages the Magellan program.

MINORITY CONTRACTORS OF THE YEAR

NASA's Office of Small and Disadvantaged Business Utilization, has selected Communications Electronics International (CEI), Orlando, Fla., and New Technology, Inc. (NTI), Huntsville, Ala., as its minority contractors of the year.

Because of the quality of work both companies exhibited, this is the first time two contractors have been selected.

CEI, a Kennedy Space Center, Fla., contractor, fabricated a vital Patch Distribution Assembly in which the company had to crimp and connect 12,908 wiring connections–a task performed 100% error free. The firm was selected because of its outstanding performance under that contract.

NTI provides hardware and software engineering and operations and software maintenance for NASA's Marshall Space Flight Center's Huntsville Operations Support Center, Data Reduction Facility and Payload Crew Training Center. The firm was recommended for the award based on its excellent services during the 8 years it has supported the center.

Goddard Signs Contract for New Center for Excellence

A new Center for Excellence for Space Data and Information Sciences (CESDIS) has been established at NASA's Goddard Space Flight Center, Greenbelt, Md.

The center is associated with the University of Maryland and the University Space Research Association (USRA), Columbia, Md., a consortium of more than 60 universities. Sponsorship comes from NASA's Office of Aeronautics and Space Technology and Office of Space Science and Applications, Washington, D.C.

A $4.8 million cost-plus-fixed-fee contract has been awarded to the USRA to manage and staff the center for the first three years with options for two or more years.

The CESDIS will be an institute without walls that will foster an innovative environment for research by the academic and industrial computer sciences community to develop new techniques and to apply new technologies to handle NASA's problems in the transmission, manipulation and interpretation of vast quantities of data.

1988 Presidential Rank Awardees

President Reagan recently approved the selection of the 1988 Presidential Rank awardees.

This honor is bestowed on a small number of career Senior Executive Service members whose career achievements are exceptional. Each year only 1% of the federal government SES executives may receive the rank of "Distinguished Executive," with a $20,000 stipend, and 5% may receive the rank of "Meritorious Executive," with a $10,000 stipend.

NASA's 1988 honorees include 5 Distinguished of the 60 government-wide and 26 Meritorious Executives of the 296 government-wide. The Distinguished Rank Awardees were honored by President Reagan at the White House on August 2, 1988. Meritorious Rank Awardees were honored at a government-wide reception at the Department of Agriculture on September 20, 1988.

Distinguished Awardees

William F. Ballhaus, Jr., Director, ARC (Currently Acting Associate Administrator for Aeronautics and Space Technology)

Jon R. Busse, Director of Engineering, GSFC

Aaron Cohen, Director, JSC

John E. O'Brien, General Counsel, Headquarters (Recently Retired)

James B. Odom, Director, Science and Engineering Directorate, MSFC (Currently Associate Administrator for Space Station)

Meritorious Awardees

Theodore G. Ayers, Deputy Director, Flight Operations and Research Directorate, ARC

Robert C. Baumann, Director of Flight Assurance, GSFC

Thomas Campbell, Comptroller, Headquarters

Louis D. DeAngelis, Director, Human Resources and Organization Development Office of Management, Headquarters

Michael B. Duke, Chief, Solar System Exploration Division, JSC

Stuart J. Evans, Assistant Administrator for Procurement, Headquarters

Margaret G. Finarelli, Director, Policy Division, Office of Space Station, Headquarters

Edward A. Frankle, Deputy General Counsel, Headquarters

Carson M. Giesler, Manager, Space Station Projects Office, KSC

William D. Hager, Assistant Inspector General for Investigations, Headquarters

J. Warren Littles, Deputy Director Science and Engineering Directorate, MSFC

William R. Marshall, Manager, Shuttle Projects Office, MSFC

George F. McDonough, Jr., Director, Structures and Dynamics Laboratory, Science and Engineering Directorate, MSFC

Kenneth S. Pederson, Deputy Associate Administrator for External Relations, Headquarters

David J. Poferl, Director of Technical Services, LERC

Leroy L. Presley, Chief, Aerodynamics Division, ARC

Richard A. Reeves, Associate Director, ARC

C. Howard Robins, Jr., Deputy Associate Administrator for Management, Headquarters

Bill H. Sneed, Assistant Director for Policy and Review, MSFC

Steven V. Szabo, Jr.., Director of Enginering, LERC

Gerald D. Walberg, Chief, Space Systems Division, LARC

Robert T. Wingate, Deputy Director, Systems Engineering and Operations, LARC

Howard T. Wright, NASA Deputy Program Manager, National Aero-Space Plane Program (NASP), NASP Joint Program Office, Wright-Patterson Air Force Base

John W. Young, Special Assistant for Engineering, Operations, and Safety, JSC

Joseph A. Ziemianski, Chief, Propulsion Systems Division, LERC

HUMAN FACTORS

Hinners Named Associate Deputy Administrator, Succeeds Shapley

NASA Administrator Dr. James C. Fletcher has announced the appointment of Dr. Noel W. Hinners as Associate Deputy Administrator.

Hinners, currently Associate Deputy Administrator (Institution), succeeds Willis H. Shapley who is retiring but will continue to serve as a consultant to the Administrator.

As Associate Deputy Administrator, Hinners will be the third ranking official of NASA and the principal senior assistant to the Administrator and Deputy Administrator Dale D. Myers in the leadership of the agency. Hinners will continue as NASA chief scientist and to exercise his present functions of supervising institutional management in NASA. His present position of Associate Deputy Administrator (Institution) is being abolished.

Hinners is a career civil servant who first joined NASA in 1972 as deputy director of lunar programs, Office of Space Science. From 1974 to 1979, he was NASA Associate Administrator for Space Science. He was director of the Smithsonian Institution's National Air and Space Museum prior to being appointed director of the Goddard Space Flight Center, Greenbelt, Md., in 1982, a position he held until his current appointment.

Hinners was born in Brooklyn, New York, Dec. 25, 1935, and educated at Rutgers University, California Institute of Technology and Princeton University where he received his doctorate in geochemistry and geology.

Shapley, also a career civil servant, served in the Bureau of the Budget, the predecessor of the Office of Managment and Budget, from 1942 to 1965. He joined NASA in 1965 as Associate Deputy Administrator and served in this position until his first retirement in 1975.

He rejoined NASA at the urging of Dr. Fletcher in 1987 to help NASA recover from the Challenger accident. He first served as Associate Deputy Administrator (Policy) and later as Associate Deputy Administrator where he was a principal advisor to the Administrator on policy and related matters. His commitment to Dr. Fletcher was until the STS-26 flight was completed and in the words of Dr. Fletcher, "He's served his country well–God speed".

Ballhaus, Cohen, Simpson Inducted into the National Academy of Engineering

William F. Ballhaus, Jr., acting associate administrator, OAST; Aaron Cohen, director, JSC; and Joanne Simpson, head, Severe Storms Branch, GSFC, have been inducted into the National Academy of Engineering in Washington, D.C.

Established in 1964 under the charter of the National Academy of Sciences as a parallel organization of outstanding engineers, it shares with the National Academy of Sciences the responsibility for advising the federal government.

The National Academy of Engineering also sponsors engineering programs aimed at meeting national needs, encourages education and research, and recognizes the superior achievements of engineers.

Ballhaus, Cohen and Simpson join 1,408 members of the Academy who represent the engineering profession's highest standards. This recognition honors them and reflects favorably on NASA.

NEBA
From page 9

insurance. NEBA also provides almost 3,000 employees with the Travel Accident Plan. In 37 years, these plans have paid over $42,000,000 in claims to NACA/NASA families.

NEBA's factors for success:

- The continual backing of the NEBA plan by the top management at Headquarters and the field installations, commencing with Dr. Hugh L. Dryden.
- The dedicated work of the NEBA Chapter officers in serving their fellow employees.
- The expeditious and satisfactory handling of claims by the insurance carrier.